

APPENDIX-continued

```

KP :;
KI :;
KD :;
HP=0;
RPB=0;
XYHomeJ=0;
IdleTM=0;
ITime=0;
JS #INITGL
JS #INITWL
EN;
rem End #INITL *****
rem *** Ieris Friction Welding Inc
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rem
#WELD1
HX ;
RPB=0;
MG "Weld Cycle Started"
ER=WeldFE;
OE=1;
rem
TL WeldTL;
GN WeldGN;
SP WeldSP;
AC WeldAC;
DC WeldDC;
KP WeldKP;
KJ WeldKJ;
KD WeldKD;
Dist=PPR*WeldRev;
Dist=Dist-(PPR*TngRev);
PR Dist;
TW SOC;
BGX;
MG "Scrub . . . "
rem Scrub start
AT 0;
AT ScrubTM;
rem Burn start
CB1;
MG "Burn . . . "
AD Dist2;
rem WTS0N
rem Forge Start
CB 1;
SB 1;
MG "Forge . . . "
AMX;
KP WeldKP2;
WT ForgeTM;
SG 2;
MG "Weld complete"
WT 1000
KP WeldKP;
EN;
rem End #WELD: *****
rem
#CYCLE
JS #HOME;XYHome=;
JS #WELD1;
XO #IDLE;
EN;
rem End #CYCLE *****
#MTIME
MG "Position timeout . . . "
RE
rem End WELD,CYCLE MODULE *****
rem
#INITGL
rem
rem. GLOBAL VARIABLES
rem
rem
rem. PULSES PER INCH
PPI=1000.00000;
rem PULSES PER REV
PPR=754.2249

```

APPENDIX-continued

```

rem. Timer Ticks Per Second
TPS=1000
rem. Input Volt Per Unit
IVIPKPM=2.00000
IVIPPSI=3.00000
rem. Output Volt Per Unit
OVIPRPM=2.00000
OVIPTSI=3.00000
rem. Sample Rate
SampleRate=100
rem. Number of IO
rem. Hopping following error chunk
HomeFE=2000;
HomeVel=1000;
HomeAcc=500;
HomeDec=500;
HomeP=.8;
HomeI=.02;
HomeD=.0;
GHomeVel=1000;
FTVel=1000;
rem. Software limits
XFLimit=11.00
YFLimit=11.00
XBLimit=-0.100
YBLimit=-0.100
OverIO=1
rem Max Move Values
MaxXMVel=10
MaxXMAcc=40
MaxXMDec=40
EN
rem
rem Weld start values
#INITWL
rem *** Ieris Friction Welding Inc
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rem
rem Weld specific params
WeldRPM=1750
ScrubTM=200;
ForgeTM=4000;
WeldRevS=10
Degrees=0
TrigRev=0.5
rem
rem. PID params
WeldAcc=100
WeldDec=100
WeldKP=0.5
WeldKP2=1
WeldKJ=1.02
WeldKI=50
WeldFErr=1.5
WeldTL=9.9988
WeldGN=20
rem
rem. Calculated parameters
WeldRev=(Degrees*360)*WeldRevS;
WeldSP=(WeldRPM*PPR)/60;
WeldAC=(WeldAcc*PPR)/60;
WeldDC=(WeldDec*PPR)/60;
WeldFE=WeldFErr*PPR;
rem
rem. End weld.txt *****
EN
rem. End #INITLW *****

```

APPENDIX

```
rem *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
rem:
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
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rem:
rem: *** #MAIN
rem: This is the main program task
#MAIN
JS #INIT
NO #IDLE;
#MAIN1
JS #CYCLE,@IN[1]=0;
JS #HOME,HPE=1;
JS #WFLD1,RPR=1;
JP #MAIN1
EN
rem: End #MAIN-----
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
rem: *** #HOME
rem: Home function
#HOME
HX 1;
HFB=0;
MG "HOME"
XYHomeD=0;
HomeD=1;
Kev1,Salt1,Kev1,Salt1;
ER HomeFE;
AC HomeAcc;
DC HomeDec;
K1 HomeF1;
K1 HomeI;
KD HomeD;
IL 2;VT 1;
#HOMEX
MG "Homing . . . "
```

APPENDIX-continued

```
StzMsg="HOMEX"
rem: Make sure of home switch
MG "Get off home switch . . . ";
JG #HOMEBOX;
#WFX2JP #WFXC,@IN[2]=0;
WT 500
STXANDJP #HOMDX,@IN[2]=0;
MG "Off home switch . . . ";
rem: Find home LS
MG "Looking for home switch . . . ";
#WFX1;
PK 5;MV;AMX;
JP #WFX1,(@IN[2]=1);XPose= TPX;
MG "Home switch found . . . ";
rem:
rem: Go back to home position
SP FTVel;
PA XPos:BG.AM1:DPO;
MG "Slides Homeed . . . "
#HOME1
XYHomeD=1;
XO #IDLE;
EN
rem: End #HOME-----
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
rem: *** #POSERR
rem: Position following error
#POSERR
ZS;
JS #HALT;
MG "FOLLOWING ERROR"
StzMsg="FOLERR";
ZSJp #MAIN;
RF;
rem: End #POSERR -----
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
rem: *** #HALT
rem: Brings motion to a stop
#HALT;
StzMsg="HALT";
ER=-1000;II 0:AB 1:WT 1000;
SH,CS,HX 1:MO;
OP255;
rem: JS #CLEARIO,
MG "Servo program halted . . . "
EN
rem: end #HALT -----
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
#IDLE
[IdleTM=TIME
#IDLE];
JP #IDLE1,TIME=Idle1 MC1(JJJ);
TIME=TIME-1;
MG "Servo Ready . . . ",Time(F0)
JP #IDLE;
EN
rem: End #IDLE -----
rem: *** Iterus Friction Welding Inc
rem: *** Copyright 1996
rem: *** All rights reserved
rem:
#INT
SB 1:SB 2:SB 3:SB 4;
SB 5:SB 6:SB 7:SB 8;
ER=-100;
OE=1;
TL 1;
GN 1;
AC 5%0;
DC 5%0;
```